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*Vermont Housing Health Code Compliance:
A Quality Assurance Analysis of the Rental
Housing Inspection Checklist*

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Environmental Studies Thesis
University of Vermont College of Arts and Sciences

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Environmental Studies at the University of Vermont

Abstract

Substandard housing is a prevailing public health concern in the United States. With millions of Americans living in inadequate buildings, housing-related illnesses warrant increasing recognition. Accordingly, implemented housing construction standards and housing health codes have ensured that existing structures are safe. The Vermont Department of Health's Environmental Health Section, recently updated the Town Health Officer's Rental Housing Inspection Checklist, a tool used to enforce rental-housing health codes in Vermont. To examine the utility of the updated inspection checklist we conducted a pilot study, which consisted of field-testing the checklist with Town Health Officers and then administering a quality assurance survey to them. Overall, participants' responses demonstrated their approval of the updated version. Refining the Town Health Officer's Rental Housing Inspection Checklist was an important measure toward ensuring compliance with the Vermont Rental Housing Health Code.

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Introduction

Housing is a basic human need, but there has historically been great variability in the type and quality of housing in human society. Currently in the United States, most people have what may be considered “adequate” housing that generally protects them from extreme weather. However, there is an increasing body of evidence linking the condition and quality of a residential dwelling to the health of its residents. Poor housing conditions such as the presence of mold, lack of ventilation, and inadequate construction are associated with morbidity ranging from asthma and chronic lung disease, to injuries and mental health disorders (Krieger, 2002). The Vermont Department of Health (VDH) has recently focused on the issue of "healthy housing," as a way of promoting public health and mitigating preventable injury and disease. Residential rental property inspections and housing health code enforcement is under the auspices of the Vermont Department of Health. Local public health officers carry out inspections utilizing a code-based checklist. Components of the checklist that guide housing inspections include detailed questions about the following subjects:

1. Life Safety- smoke and carbon monoxide detectors
2. Sanitation Facilities (I)- kitchen facilities, bathroom facilities
3. Sanitation Facilities (II)- water supply, wastewater and garbage disposal
4. Insects and Rodents
5. Heating
6. Natural and Mechanical Ventilation
7. Lighting and Electricity
8. Structural Elements
9. Vermont Lead Law

In 2009, a Department decision was made to update the "Town Health Officer Rental Housing Inspection Checklist," in order to improve the efficiency of housing inspections and interventions, thereby better protecting community wellbeing. The

Vermont Department of Health redesigned the rental housing inspection checklist in 2009 in order to follow the state's rental housing health code more closely and to make the inspection process more straightforward. Before it could be release for routine use the Department felt it was necessary to obtain feedback from the Town Health Officers (THO), who regularly use the checklist during housing inspections. Using a survey tool developed for the purpose of this study, the Department solicited responses from the THOs to gain insight into how they perceived the checklist's updated format. Their feedback aided in making alterations to the checklist.

This quality assurance project employed an evidence-based approach to healthy housing in Vermont. Its overall goal was to systematically evaluate the updated checklist's content and structure in terms of its practical utility for assessing rental property compliance with state health codes. The survey allowed THOs to evaluate the checklist's accuracy in identifying specific risks and measuring housing condition, as well as its overall efficacy. Improvements to the checklist's functionality and utility, such as adding "notes sections" and reinstituting section one (Life Safety) generated a more user-friendly, effective tool for assessing rental housing quality in Vermont.

Literature Review

Healthy Housing: *an examination of housing interventions as a means of improving public health*

"I have a 6-year-old patient who presented with severe asthma after moving into a large multifamily dwelling. Public Health nurse described mold on walls, dripping faucets, one small window in the whole place, roach infestation, mom and 3 kids slept in one room on a mattress on the floor," (Krieger, 2002).

Adequate shelter is a fundamental human need, designed to protect us from nature's harsh elements (Winslow, 1938). Too often in our current society, housing fails to provide even the basic functions of protecting our wellbeing. Visible and non-visible hazards within dwellings have been shown to affect the welfare of their inhabitants. Structural inadequacies and toxic exposures within existing properties are primary risks to human health. Issues surrounding "healthy housing" especially threaten marginalized communities where low-income populations may be unknowingly exposed to unsafe environments (Jacobs, 2009). Substandard housing, acting as a vector of physical and mental illness, affects over 5 million American families today, posing a detriment to public health (Nelson, 2000).

This literature review examines the human health effects as a result of inadequate housing, and explores the successes and limitations of housing interventions at the public health level. It also investigates the solutions to public health hazards in the home and the efficacy of housing inspections in determining housing habitability.

Efforts to improve housing, as a means of enhancing human health, have been widely accepted for over a century (Jacobs, 2009). Investigations into the adequacy of

housing began in the mid 1800's, as evidence showed that improvements in housing quality and sanitation led to demonstrable health gains by controlling outbreaks of cholera, typhoid, tuberculosis, and other diseases. These health gains prompted political efforts to regulate housing quality. Accordingly, many of the standards for healthy, safe buildings have been codified into law in the U.S. and globally (Jacobs, 2009). Today, as an increased pervasiveness of chronic lung disease and asthma pervade the health profile of the industrialized population in the U.S., the link between housing and health has received renewed attention (Jacobs, 2009). Healthy housing is an increasingly prevalent concern that warrants attention in order to promote public health and mitigate preventable illness.

Housing as a Determinant of Health

An abundance of scientific evidence has demonstrated a relationship between substandard housing and poor quality of health (Krieger, 2002). A "health hazard" is defined as an illness or exposure that compromises or diminishes human health (Hussman, 1999). Few studies have examined the physical, chemical, biological, and social aspects of health impacts from inadequate housing, however those that have undertaken this project have discerned a clear trend showing housing deficiencies decreasing quality of health (World Health Organization Europe, 2005).

Asthma, a chronic condition characterized by intermittent attacks of airway constriction, wheezing and breathlessness, represents one of the most widespread chronic diseases among children in the United States. Typically induced by chronic exposure to indoor allergens, "allergic asthma" affects over half of the 20 million Americans diagnosed with asthma (Buchan Lawton Parent Ltd., 1998). "Allergic asthma," means

that airborne particles, such as pollen, pet dander, and dust mites trigger an allergic response, often resulting in an asthma attack (Office of Healthy Homes and Lead Hazards Control, 2008). A study by Huss et al (2001) demonstrated that in-home dust mite allergens exhibits a dose-response curve, showing that increased exposure to allergens results in increased risk of allergic sensitization (Jacobs, 2009).

Figure 1

Dose-response curve from Huss et al's study. Increased exposure to dust mite allergen resulted in a increased prevalence of allergic sensitization to mites (Huss, 2001). (Deleted from online version).

Additionally, cockroach and rodent infestation as well as mold in a home, have shown similar effects (Rauh, 2002). Surprisingly, 63% of dwellings in the U.S. exhibit a detectable level of cockroach allergen, and about 10% of U.S. homes demonstrable levels above a sensitization threshold (Jacobs, 2009). Similarly, rodent infestation, and consequent allergen exposure, has been shown to induce asthma (Jacobs, 2009). These allergens, typically found in the animal's dander and urine, can easily become airborne then inhaled, and can cause airway inflammation (Jacobs, 2009). Inhalation of mold has also proven to significantly increase allergic sensitization. In fact, mold exposure in housing is attributed to about 21% of current asthma cases (Jacobs, 2009). Clearly, chronic exposure to several factors in the home can lead to the development of asthma and allergic sensitization.

Structural deficiencies in the home have also been associated with adverse health effects. "Unintentional injury," for example, is a primary health consequence of deficient building structure. In the realm of healthy housing, the term, "unintentional injury" is described as preventable accidents as a result of a building's substandard construction or

dilapidation (Office of Healthy Homes and Lead Hazards Control, 2008). Participants at the WHO Technical Meeting on Quantifying Disease examined a variety of housing factors for which evidence reported specific adverse health outcomes as a result of inadequate building structure. Some that they identified included cold temperatures and increased winter mortality, radon exposure and rates of cancer, and excess heat due to lack of ventilation and cardiovascular effects (World Health Organization Europe, 2005). The existing health hazards associated with substandard housing are not limited to the previously described examples. (Office of Healthy Homes and Lead Hazards Control, 2008)

Toxicant exposure in the home can also result in serious adverse health effects. Toxicants enter the body through one or more of three ways: ingestion, inhalation, or absorbed through skin (Woodruff, 2010). Once they enter the body, they can target certain organs where they exert their effects, causing internal complications. Lead-based paint in particular is hazardous to human health since inhalation or ingestion of lead-laden dust from peeling or chipped paint can cause a range of health problems, especially in young children (Office of Healthy Homes and Lead Hazards Control). Lead is known to cause serious neurological effects and, in fact, recent research has indicated that even low concentrations of lead in the blood were linked to deficits in cognitive abilities among adolescents, and according to the Vermont Department of Health, lead paint is the leading cause of lead poisoning in children (Office of Healthy Homes and Lead Hazards Control, 2008; Vermont Department of Health, 2005). A survey by the Department of Housing and Urban Development (HUD) found that approximately 40% of homes in the United States contain lead-based paint and are therefore contaminated with lead dust (Office of Healthy Homes and Lead Hazards Control, 2008). The preventable risks

associated with substandard dwelling continue to affect millions of people across the nation.

Vulnerable Populations

Housing risks affect people in different ways, as some sectors of the population are more susceptible to their effects than others. These cohorts include infants and children, the elderly, immune compromised patients, and those with existing respiratory diseases (Jacobs, 2009). Children and infants compose a significant sector of the U.S. population and are also extremely susceptible to housing malfunctions. There is significant evidence to support this claim: 1) children's bodies are comparatively small and are constantly growing, making they are more susceptible to absorbing and retaining lead and other toxins; 2) children's brain and nervous system undergo a pivotal growth stage during that life-stage, making them more sensitive to the damaging effects of exposures; 3) children constantly put their hands and other objects into their mouths, and these objects could be contaminated with lead dust or mold spores (U.S. Environmental Protection Agency, 2009). Finally, since as much as 80-90% of children's time is spent in an indoor environment, they face a higher potential for exposures to indoor allergens (Breyse, 2004). In addition, the elderly, immune-compromised, and individuals with existing respiratory diseases are also at heightened risk to health hazard due to faults in a home (Breyse, 2004; Shortt, 2007). Protecting these vulnerable populations is particularly important given their heightened susceptibility.

Solutions to Mitigating Housing-Related Health Threats

"Addressing housing issues and improving access to good quality, affordable housing requires a combined effort from a range of agencies, including those in the

public, private, and government sectors" (Jacobs, 2007). Ensuring lasting solutions using this kind of multidisciplinary approach requires comprehensive research and cost-benefit analyses. For instance, current research indicates that the most effective approaches to reducing housing-related health risks include enforcing housing policies and corresponding health codes, educating residents, and performing home environmental assessments.

Connecting aspects of environmental health, housing, building design, and community development with corresponding laws, codes, and policies is a fundamental way that authorities can significantly promote public health (Levy, 2006; Jacobs, 2007). The CDC has established general guidelines for housing standards, which health agencies on the local level can adopt, and further develop or tailor to address specific needs in their communities (Center for Disease Control and Prevention, 2008). A state's health department can sponsor educational and health promotion campaigns and programs which would supplement these guidelines. For instance, the Office of Healthy Homes and Lead Hazards Control (OHHLHC) provides grants to communities seeking to eliminate childhood lead poisoning by controlling lead-based paint hazards in privately owned homes (Office of Healthy Homes and Lead Hazards Control, 2008). Through educating residents and working within communities OHHLHC grant programs have successfully reduced or eliminated health hazards in thousands of homes across the United States (Office of Healthy Homes and Lead Hazards Control, 2008). Through intensive community involvement, residents can become more informed, and ultimately improve their household environments (Saegert, 2003). Housing codes as well as other policies and programs can be valuable means of preventing housing-caused health deterioration. These types of prevention-oriented model allows agencies to define the necessary

resources and techniques for eliminating hazards in properties (Jacobs, 2007).

Housing codes can be a very effective tool, though they must be efficiently enforced; in fact, without proper enforcement, the established policies fail to address public health hazards or remediation of substandard housing conditions (Krieger, 2002). In Vermont, Town Health Officers have broad statutory authority to enforce the provisions of polices and rules issued by the Vermont Department of Health within their jurisdiction. They respond to health code-related complaints, filed by tenants or landlords, by performing property inspections to investigate and mitigate any potential or existing health threats in the rental property (Vermont Department of Health, 2009). These officers are expected to be versed in the Vermont statutes that apply to the local board of health, and to be familiar with the overall health condition of their town (Vermont Department of Health, 2009). When healthcare workers and government agencies work together to implement these strategies, communities across the nation can systematically create living environments that will not harm, but actively promote the wellbeing of its citizens (Jacobs, 2007).

Housing Inspections

Housing inspections are an important method through which health officials can assess the habitability of housing and enforce health code polices. During most property inspections, trained personnel use a checklist containing a comprehensive list of health codes to help them identify and address violations. In Vermont, Town Health Officers use the, "Town Health Officer Rental Housing Inspection Checklist," to aid in identifying housing violations that compromise residents' health and safety. The Vermont Department of Health uses the Healthy Housing Inspection Manual, a general template

for housing inspections developed by the Center for Disease Control and Prevention, as a reference tool that local jurisdictions can customize based on their town's circumstances (Environmental Health Service Branch, 2008).

Vermont's Town Health Officer Rental Housing Inspection Checklist consists of nine sections that cover the housing health code. Issues such as basic sanitation and structural integrity of a property are fundamental to the health of its inhabitants. Ensuring that there is functional heating, plumbing, safety alarms, and freedom from vermin as well as Vermont Lead Law compliance are essential to the housing health code. Identifying specific lapses in these areas is the essential objective of the inspection checklist.

The thoroughness of any inspection checklist is important since it represents a fundamental method of defense against public health hazards in a community. Questionnaire design choices can influence data procurement as well as the quality of the collected data (Sanchez, 1992). In order for an inspection checklist to be truly effective, its language must be clear and concise, its order of topics must be relevant, it must address all aspects of the established housing-health codes, and it must be easy to follow.

If a town does not have a home-inspection system in place, residents can carry out their own inspection using environmental sampling kits to detect health hazards in their home (Office of Healthy Homes and Lead Hazards Control, 2008). The resident can then send their samples to a certified Public Health Laboratory for analysis (Vermont Department of Health, 2005). This method of intervention places the responsibility on the tenant, which could be problematic since he/she may not be versed in environmental sampling. Thus, it is very important that trained authorities perform regular inspections and collect environmental samples in homes if necessary for certain toxicants. An

integrated health strategy crucial for improving housing quality and promote public health.

Barriers to Eliminating Housing-Related Health Problems

Achieving "healthy housing," in many circumstances, is precluded by several types of barriers. Money, not surprisingly, is a key obstacle in this effort. The high cost of equipment for repairs or for lead-testing kits can affect the residents' ability or motivation to eliminate hazards in their homes (Breysee, 2004). Behavior is a second major barrier to ensuring health-promoting conditions. For instance, if a resident is not willing to change a destructive behavior such as smoking, or is unwilling to dispose of garbage properly, then the prospect of a "healthy home" is significantly curtailed (Hussman, 1999).

Attempting to solve housing-related health issues on a political level can also present strong impediments. Lack of congressional cohesiveness and bipartisanship can delay the establishment of new laws, and ultimately let hazards build (Jacobs, 2007). As a result, political rifts pose serious limitations to the field of "healthy housing" certain hazards (Rhode Island Department of Health, 2009). Clearly, several obstacles currently prevent the complete panacea for the housing-health predicament. In order to move forward in this field, to prevent public health hazards before they occur, housing remediation must become affordable and accessible for all residents.

Addressing Barriers and Promoting Health

Future directions in the realm of "healthy housing" involve addressing the previously described barriers and promoting healthful communities. One way to accomplish this is by increasing funding to state health departments. This will allow for better enforcement of the laws and policies that are designed to protect the public's

wellbeing by developing housing inspection surveys, initiating educational campaigns, and providing tools for community members. Also, as new products are constantly introduced to the market, further research is needed to determine the threat level of interactions and synergies among allergens, as well as other risk factors are still not well understood (Breysse, 2004). Further research is also necessary for providing insight into how solutions can reduce exposure and improve health status (Saegert, 2003; Jacobs, 2009). Saegert et al. (2003) recommends an ecological paradigm as a guide to more effective approaches. With this type of intervention, behavior, the physical and social environment, and health connect with the individuals, households, buildings, and communities (Saegert, 2003). Another approach to tackling this issue is by updating local housing codes to reflect current knowledge of healthful housing (Krieger, 2002). By refining building polices, inspectors will be better equipped to identify housing deficiencies, and can therefore enhance their prevention-based approach to "healthy housing". Overall, the field requires a multidisciplinary coalition of researchers, policymakers, appropriators, and advocates to fill data gaps, support needed research, and pursue policy changes (Breysse, 2004).

Escalating rates of preventable chronic disease point to the effects of substandard housing as a primary culprit. Solutions to this quandary are only imminent due to considerable obstacles. The problem of substandard housing requires urgent action from a range of authorities and community members if this issue is to be efficiently attenuated.

Methods

A quality assurance survey aimed to determine the Town Health Officers' opinions about the updated inspection checklist's ability to assess rental housing health code compliance. The survey also urged respondents to evaluate the updated checklist's content and format. The quality assurance survey consisted of twenty-five questions: the first nineteen questions aimed to assess the usability of the new checklist according to the THOs, and last six questions inquired about respondents' demographics (Appendix A). The survey contained both qualitative and quantitative questions, utilizing likert scale, multiple choice, "yes" or "no", and open-ended questions. Selected questions that warranted more information contained corresponding comment fields where respondents could offer their further opinion on the topic. Additionally, qualitative questions were measured using a nominal scale, which has no numerical value, and instead generated categorical data (Fink, 1995).

Subsequently, the survey was uploaded to the SurveyMonkey website, and in September 2010, the recruitment process commenced. Twenty-three THOs were previously identified as willing to take the survey, and these participants were contacted via e-mail. One month after this initial e-mail, a second set of e-mails was sent, followed by telephone calls reminding participants to fill out the online survey. Also, during THO training sessions the Department encouraged THOs to field-test the updated checklist and to participate in the survey project. Willing THOs accessed the quality assurance survey via the SurveyMonkey website. This online program was simple for respondents to use, automatically organized data, and saved all collected data in a single file.

Figure 2

Screen shot of completed quality assurance survey on SurveyMonkey website. (Deleted from online version.)

Data analysis began after all willing participants completed the quality assurance survey. Interpreting the survey results involved a variety of statistical methods. For instance, qualitative measuring techniques served in analyzing the survey's open-ended questions, while quantitative techniques aided in analyzing ordinal-scale questions. Using SurveyMonkey's statistical software, results of each question were uploaded to individual Microsoft Excel spreadsheets. In order to display the results in a more comprehensible format, corresponding graphs were generated for each question. While most graphs displayed the results of a single survey question, additional graphs that displayed the results of two questions cross-tabulated against each other were created to reveal additional relationships.

Results

Twelve of the twenty-three THOs who were initially identified as willing to participate in the project, ultimately agreed to field test the updated checklist and complete the quality assurance survey on SurveyMonkey. This sample represents about four percent of the total THO population in Vermont. Respondents, on average, have been town health officers for about 4 years, and all were town employees. Out of the twenty-five questions on the quality assurance survey, twelve were used in data analysis.

The table below shows that all but two of the respondents were able to field-test the updated inspection checklist before taking the survey online. Almost all respondents thought the questions correlated well with the rental housing health codes, and that the sections flowed logically with how they walked through the house. Furthermore, all respondents thought that the check boxes were clearly labeled.

	YES	NO
Did you complete the Town Health Officer Rental Housing Checklist?	10	2
Would you make any changes to the checklist?	7	5
Do the questions correlate with or relate well to the rental housing codes?	11	1
Are there valuable topics missing from this checklist?	3	5
Did the sections flow logically with how you walked through the house?	7	2
Were the check boxes that followed the questions clearly labeled?	12	0

Table 1

Compiled "Yes/No" questions from survey. Majority answers are in bold.

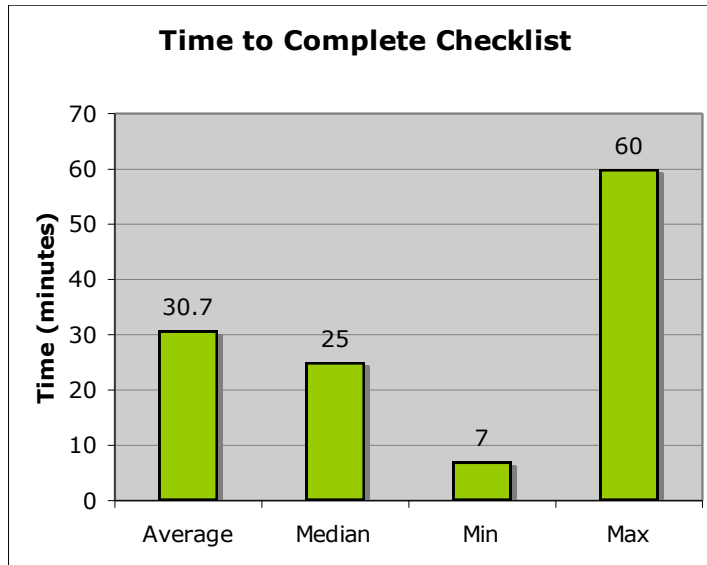


Figure 3

Average amount of time needed for respondents to complete the checklist during field-testing.

The above chart shows that on average, it took the respondents 30 minutes to complete the checklist, but this mean time was driven up by response of 60 minutes. Since median was 25 minutes, majority of respondents completed the checklist in less than 30 minutes.

Analyzing the two questions, "when" did respondents complete the checklist against "how" would respondents describe the length of the checklist, revealed associations between the two variables. The chart below shows that while no respondents thought the checklist was too short, five respondents thought the checklist was too long. Cross-tabulating these questions showed that four of those five respondents who thought the checklist was too long, completed the checklist after the inspection. Moreover, eight respondents thought the length of the checklist was just right, and seven of those eight people completed the checklist during the inspection.

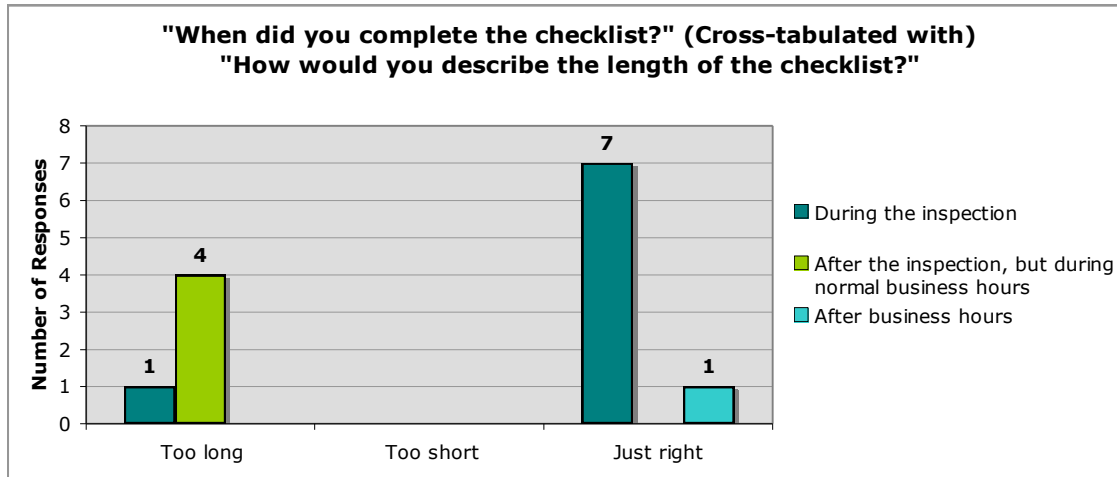


Figure 4

Cross-tabulation of questions 3 and 5: "When did you complete the checklist" against "How would you describe the length of the checklist."

The graph below demonstrates that a majority of the respondents thought it was often clear what the survey's questions were asking. Also, none of the respondents thought that the questions were rarely clear.

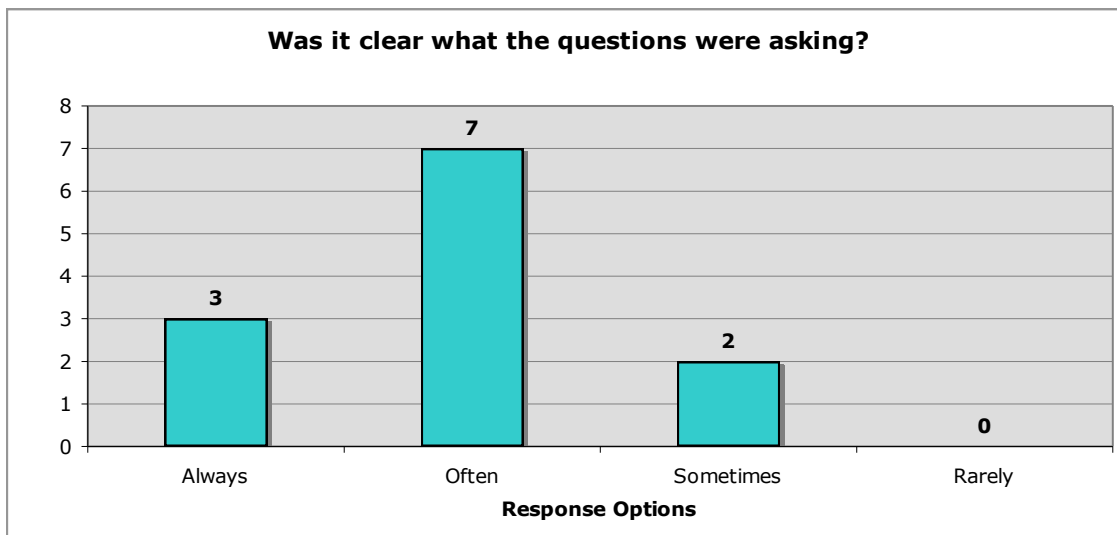


Figure 5

Ten of twelve respondents thought the questions were at least often concise.

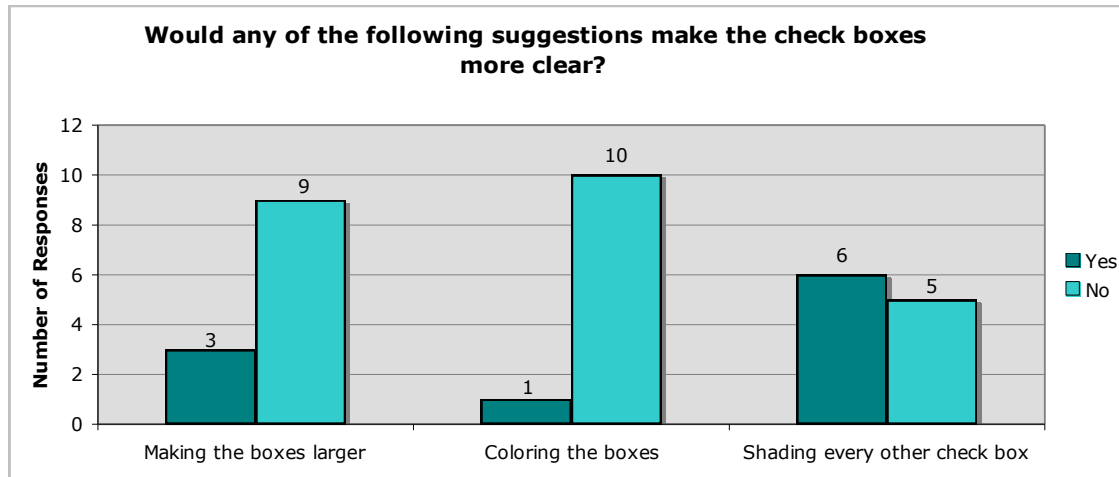


Figure 6

Respondents' opinions regarding making the boxes larger, coloring the boxes, and shading every other check box.

Figure 6 shows that, in this particular question, all twelve respondents answered "yes" or "no" for the first option ("making the boxes larger"), but only eleven people offered their opinion for the second two options ("coloring the boxes" and "shading every other check box"). One quarter of the respondents agreed that making the boxes larger would help make the check boxes more clear, and ten out of eleven people thought that coloring the check boxes would not clarify the boxes.

The below graph (Figure 7) shows that on average, the respondents rated the checklist an 8.1 on a scale of 1 to 10. The median rating was an 8, suggesting a relatively symmetrical distribution of responses. ($\sigma = 1.3$, margin of error: $\pm .826$).

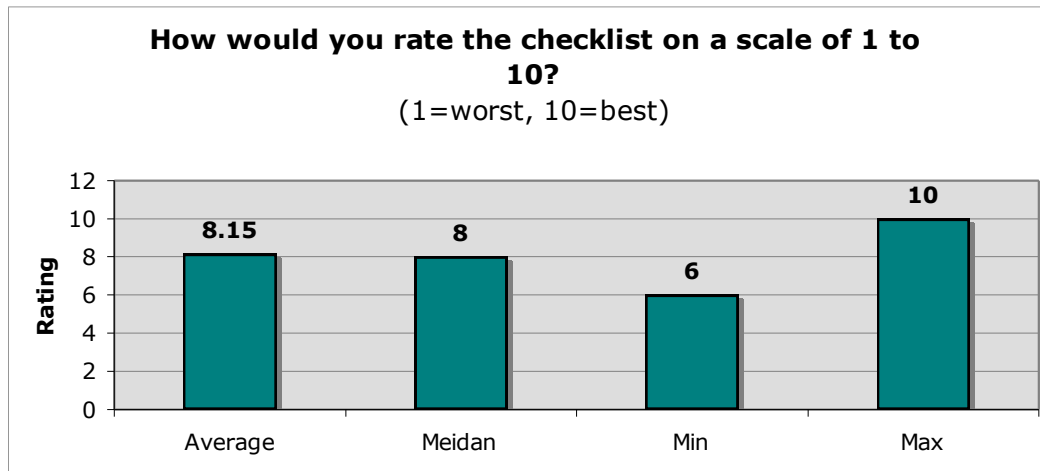


Figure 7

Checklist's average rating on a scale of one to ten, according to respondents.

Altogether, the results represent the organized information gathered from the quality assurance survey. The THOs' responses displayed several trends that are explained in the following section.

Discussion

Checklist Completion

The above results indicate that the checklist was not difficult to complete, and that respondents felt it was not time-consuming. Respondents who have required more time than average to complete the checklist (Fig. 3) may because they struggled with certain parts or were not used to the new checklist format. Many of the respondents saw the updated version for the first time while they were field-testing it, and were therefore not familiar with it. As a result, they may have stumbled over some new parts. In contrast, those who completed it much faster may have studied the checklist prior to field-testing.

Another general trend showed that those who completed the checklist during the inspection thought the length of the checklist was "just right." For instance, out of the eight respondents who completed the checklist during the inspection, seven of them found the length to be "just right." In contrast, all four respondents who completed it after the inspection found the length to be too long (Fig. 4). Also, four respondents who finished the checklist faster than the mean completion time, but after the inspection, thought the checklist was too long. This further evidences the relationship between when the respondents completed the checklist and how they perceive the checklist's length. It can therefore be said that the variable, "when the checklist was completed" is an important factor that influences respondents' perception of the checklist's length, and that the amount of time it took respondents to complete the checklist did not influence their perception of the checklist's length. If respondents learned to complete the checklist

efficiently during the inspection, rather than afterwards, then more respondents would consider the checklist's length as "just right".

Additionally, a pattern demonstrated that one third of the respondents started at least a rough draft during the inspection and then completed a final draft sometime after the inspection. These respondents perhaps were not able to finish the checklist during the inspection due to time constraints, or because they preferred to minimize their time spent at the inspection site. Finishing a final copy of the checklist after the inspection may have also increased their completion time. Since finishing the checklist after the inspection increased its perceived length, it would be beneficial for the THOs to learn to complete the checklist at the inspection site. This would save the THOs time and influence their perception of the checklist's length.

Since the checklist is most effective when completed during the inspection, THOs should strive to complete checklist at the inspection site. In order to increase the utility of the checklist, the Department should provide additional THO training sessions that review the details of the updated checklist and offer tips to completing the checklist expediently. As THOs gain more experience with the updated checklist through these workshops, they may become more comfortable completing the checklist during the inspection.

Style of the checklist

The THO's feedback regarding the checklist's style helped make further necessary updates to increase its function and utility. Primarily, their responses suggested that valuable topics or sections were missing from the checklist (Table 1). Respondents mentioned that the issues of bedbugs, smoke detectors, and water quality were important

topics that should be included in the checklist. Since bedbugs have been a recent public health problem in Burlington, adding a question about bedbug infestation to the "Insects and Rodents" section will help focus THOs' attention on this issue. The topic of "Life Safety" (Section 1) addresses many important issues such as smoke detectors and water quality (Appendix B). However, the department did not include this section in the field-tested version of the checklist. Although the original checklist included questions about smoke detectors in the "Life Safety" section, that entire component was removed prior to field-testing due to concerns that this topic falls outside of the THO's jurisdiction. After a VDH committee re-visited the topic, they approved adding the section back to the checklist. However, the Department of Health will need to discuss this issue further with the Department of Fire Safety, which holds the primary authority to enforce compliance of smoke and carbon monoxide detectors. Without a legal agreement in place, these questions will remain optional for a THO to complete. Smoke and carbon monoxide detectors are important aspects of housing safety, and giving THOs this option will allow them to attenuate life safety issues in a property without overstepping their jurisdiction. In addition to the previous amendments, several respondents specifically requested a "notes" section for the checklist. A designated notes area at the end of each section will allow the THOs to make additional comments about certain issues that arise during the inspection. This will also help organize their thoughts and generate more detailed, accurate information about the properties they inspect. Altering the checklist to accommodate these modifications has subsequently increased the checklist's utility.

The THOs' input regarding the style and flow of the questions was highly beneficial in improving the quality of the checklist. A majority of the respondents (seven of twelve) agreed that the order of the checklist's sections flowed logically with how they

walked through the house (Table 1). The layout of the questions was designed to correlate to the housing health code and so the order of the sections remains the same. This decision is also supported by evidence that almost all respondents (eleven of the twelve) agreed that the questions correlate well to the rental housing health codes.

Furthermore, according to the respondents, the questions and their corresponding check boxes were easy to follow and mark, and so this aspect of the checklist was not changed. This decision is supported by the respondents' overwhelming approval of the questions' clarity: ten respondents reported that the questions were either "often" or "always" clear (Fig. 5), suggesting that the respondents could easily interpret the checklist's language. Also, all of the respondents agreed that the checkboxes following the questions were clearly labeled, and about half of them agreed that shading every other row of boxes would make the checklist easier to follow (Fig. 6). Although two respondents suggested increasing the font size of the typeface to make the checklist more legible, doing this caused unavoidable format issues, so the font size remained the same (10pt font). The checklist's format was further updated by shading the "code information" boxes and removing extraneous lines between boxes (Appendix B).

Overall, it appears the respondents felt that the updated checklist accurately assessed rental-housing quality. The respondents replied positively to the updated inspection checklist, and on average, gave the checklist an eight rating on a scale from one (bad) to ten (best) (Fig. 7). Their comments and feedback from the survey helped improve the updated checklist's to their specifications and helped generate a more user-friendly tool for assessing rental housing quality. Ultimately, this will help protect public health in Vermont.

Asthma Trigger Identification

Certain household health indicators are directly linked to chronic respiratory disease such as asthma (Rauh, 2002; Jacobs, 2009). These indicators include mold, insects, pets, and tobacco smoke (Huss, 2001). As a result, it is important a housing intervention adequately identifies and classifies observed hazards as "asthma triggers." Asthma triggers are certain allergens in the environment that causes an allergic response (Office of Healthy Homes and Lead Hazards Control, 2008). Increasing the THOs' knowledge about asthma triggers will allow them to more accurately identify these allergens during their property inspections. Moreover, recording this information will aid the Vermont Asthma Program in its ongoing asthma surveillance efforts in the state. For instance, documenting the prevalence of risk factors in Vermont homes will help direct and inform the Asthma Program's activities as well as provide information to the public about asthma in their communities (Peterson, 2005). In the most current version of the checklist, there is no specific section devoted solely to asthma triggers; instead, these types of allergen questions are embedded in particular sections throughout the rest of the checklist. Since this topic does not have its own section in the checklist, and because asthma is a burgeoning disease linked to housing conditions, it is important that THOs are proficient in asthma triggers and can readily identify them during an inspection. However, since one third of the respondents felt that the checklist was not helpful in identifying asthma triggers, and over half of the respondents were "unsure" if there was an area in their town that displayed increased rates of asthma triggers in rental properties, it may be necessary to review these topics with THOs. Offering additional training sessions that emphasize asthma triggers and the health risks associated with asthma will increase their proficiency in and identification of allergen triggers. However, due to the

lack of Health Insurance Portability Accountability Act (HIPAA) training among town health officers, the checklist will not include personal health questions (i.e. presence of asthmatics in the inspected property) so as not to breach federal regulations on medical record confidentiality. This will help answer any questions about what types of hazards are considered asthma triggers and which counties in Vermont have higher rates of asthma. This will help surveillance efforts and also for establishing public health promotion and hazard prevention programs in particularly affected areas in Vermont.

Recommendations for the Checklist

The THOs provided necessary feedback that assisted in making further adjustments to the updated checklist. The Vermont Department of Health should use this final updated version of the Town Health Officer Rental Housing Inspection Checklist (Appendix B) in order to ensure public health promotion among Vermont's tenants. The following recommendations to the updated checklist were implemented:

- 1.) A designated "NOTES" area was added at the end of each section, allowing THOs to write additional comments during the inspection.
- 2.) Section 1, "Life Safety," was reinstated to the checklist as an optional section for THOs to fill out.
- 3.) Extraneous lines and boxes were removed from the checklist to improve aesthetics and flow.
- 4.) The "code information" sections, and section sub-headings were shaded to improve the checklist's aesthetics and flow.
- 5.) The first page of the checklist was re-formatted to make efficient use of space.
- 6.) The term, bedbugs, was added to question 4.1 in the "Insects and Rodents" section.

7.) The question, "Has anyone in the property been scalded in the past six months?" was added to section 3.7 under "Water Supply/Wastewater Disposal"

In addition to the above amendments to the updated checklist, the Department should offer supplemental training session for THOs, explaining efficient use of the updated checklist, and highlighting asthma trigger identification and the life safety section.

Project Limitations

This project was limited by its small sample size. A small sample size decreases accuracy and fails to represent an entire population. By contrast, larger sample sizes increase the data's precision and validate its conclusions. The recruitment process posed unanticipated difficulty. A more aggressive approach was necessary in order to enlist more participants.

Another limitation was that two respondents did not field-test the checklist before taking the survey, so their answers were not as valid. Keeping them in the data-set anyways may have skewed some elements of the data since their answers were not necessarily applicable. Removing these two respondents from the sample entirely could have corroborated the data, but doing so would have decreased the already small sample size. A compromise would have been to add a "not applicable" choice to certain questions, making those questions optional for respondents who did not field-test the checklist.

Additionally, it would have been helpful to pilot-test the quality assurance survey with three or four participants to get initial feedback before sending it to all respondents. This would have revealed how the survey could be improved. Making the questions more

direct and tailoring them more toward the objective, would have maximized feedback. For instance, asking THOs if they caught more health code violations with this updated version would have revealed whether or not this version improved housing inspections. how to improve the checklist and inquiring about their opinions regarding the pros and cons of the previous checklist, as well as the updated checklist, could have been incorporated. This would have revealed whether or not they thought the updated version was truly an improvement from the original version. Refining the survey more before it was uploaded to SurveyMonkey would have helped generate more specific conclusions about the THO's perception of the updated checklist.

CONCLUSION and FUTURE DIRECTIONS

The goal of this project was to ultimately create a highly effective rental housing inspection questionnaire by incorporating necessary changes to the checklist based on THOs' feedback from survey results. Overall, the quality assurance survey successfully generated valuable feedback from the Town Health Officers, and this information helped enhance the checklist according to their opinions and suggestions.

SurveyMonkey was an integral component of this project that aided in methodical and timely data collection. Since SurveyMonkey eliminated the need for manual data entry, and performed basic data analysis, it saved valuable time. Utilizing SurveyMonkey also allowed the participants to reply more honestly than they would have if the questions were administered via personal interview. Cross-tabulating two questions against each other, using SurveyMonkey's statistical component, allowed for more meaningful data interpretation and deeper conclusions.

Before implementing the updated checklist, it must be subjected to legal review to seek departmental approval for its release. The Department will then provide all THOs in Vermont with a copy of the approved updated checklist. The THOs will have a chance to familiarize themselves with the checklist during training sessions before fully implementing it. THO training workshops will discuss the changes to the checklist and explain how they can most efficiently use the checklist to maximize the quality of the inspection while decreasing their checklist-completion time. Training sessions will also review asthma triggers and other specific elements of healthy housing and the rental housing health code.

A future project might compare rental-housing inspections using the original and updated checklists to investigate whether or not the updated version is superior in identifying housing health code violations. This would involve field-testing both checklists side-by-side, then analyzing and comparing the degree to which each inspection checklist assessed housing quality and health code compliance.

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REFERENCES

- Breyse, P., Nick Farr, Warren Galke, Bruce Lanphear, Rebecca Morley Linda Bergofsky. (2004). "The Relationship Between Housing and Health: Children at Risk." Environmental Health Perspectives **112**(15): 1583-1588.
- Buchan Lawton Parent Ltd. (1998). The Effect of Improving the Home Environment on Asthma: A pilot study. Housing Technology series. Ottawa.
- Center for Disease Control and Prevention. (2008). Healthy Housing Inspection Manual. U.S. Department of Housing and Urban Development. Atlanta.
- Environmental Health Service Branch. (2008). "Healthy Housing Inspection Manual Now Available " Journal of Environmental Health **71**(3): 52-53.
- Fink, Arlene. (1995). *How to Analyze Survey Data*. Thousand Oaks: Sage Productions.
- Huss, K., et al (2001). "House dust mite and cockroach exposure are strong risk factors for positive allergy skin test responses in the Childhood Asthma Management Program." Journal of Allergy Clinical Immunology **107**(1).
- Hussman, T. M. (1999). "The Health Protection Act: National Guidelines for Indoor Air Quality and Development of the National Indoor Air Programs in Finland." Environmental Health Perspectives **107**(3): 515-517.
- Jacobs, D. E., Andrea Baeder (2009). Housing Interventions and Health: A Review of the Evidence. National Center for Healthy Housing. Atlanta, Center for Disease Control and Prevention.
- Jacobs, D. E., Tom Kelly, John Sobolewski (2007). "Linking Public Health, Housing, and Indoor Environmental Policy: Successes and Challenges at Local and Federal Agencies in the United States." Environmental Health Perspectives **115**(6).
- Krieger, James and Donna L. Higgins (2002). "Housing and Health: Time Again for Public Health Action." American Journal of Public Health **92**(5): 758-768.
- Kansas University Medical Center. (2004). The Bell Curve: The Normal Distribution. Retrieved November 5, 2009 from:
http://classes.kumc.edu/sah/resources/sensory_processing/images/bell_curve.gif
- Levy, J. I., et. al., (2006). "A community-based participatory research study of multifaceted in-home environmental interventions for pediatric asthmatics in public housing." Social Sciences & Medicine **63**(8): 2191-2203.
- Nelson, K. P., Jill Khadduri, Marge Martin, Mark D. Shroder, Barry L. Steffen, and David Hardiman (2000). Rental Housing Assistance- The Worsening Crisis: A report to

Congress on the Worst Case Housing Needs. Washington, D.C., U.S. Department of Housing and Urban Development.

Office of Healthy Homes and Lead Hazards Control. (2008). Leading our Nation to Healthier Homes: The Healthy Homes Strategic Plan. U.S. Department of Housing and Urban Development. Washington, DC.

Peterson, Elizabeth. (2006). "Asthma Data 2005." Chronic Disease Epidemiology. Vermont Department of Health.

Rauh, V. A., Ginger L. Chew, Robin S. Garfinkel. (2002). "Deteriorated Housing Contributes to High Cockroach Allergen Levels in Inner-City Households." Environmental Health Perspectives **110**(2): 323-327.

Rhode Island Department of Health. (2009). "Healthy Housing and Environment Team." Retrieved October 5, 2009, from <http://www.health.state.ri.us/environment/risk/mold.php#need>.

Saegert, S., Klitzman S, Freudenberg N, Cooperman-Mroczek J, Nassar S. (2003). "Healthy Housing: A Structured Review of Published Evaluations of US Interventions to Improve Health by Modifying Housing in the United States, 1990-2001." American Journal of Public Health **93**(9): 1471-1477.

Sanchez, M. E. (1992). "Effects of Questionnaire Designs on the Quality of Survey Data." The Public Opinion Quarterly **56**(2): 206-217.

Shortt, N., Jorun Rugkasa. (2007). "'The walls were so damp and cold' fuel poverty and ill health in Northern Ireland: Results from a housing intervention." Health & Place **13**(1): 99-110.

U.S. Environmental Protection Agency. (2009). "Lead in Paint, Dust, and Soil." from <http://www.epa.gov/lead/pubs/leadinfo.htm#health>.

Vermont Department of Health. (2005). "Facts About Lead in Paint." Retrieved March 30, 2011, from http://healthvermont.gov/enviro/lead/lead_paint.aspx.

Vermont Department of Health. (2009). "Vermont Town Health Officer Manual."

Winslow, C. E. (1938). "Basic Principles of Healthful Housing: Preliminary Report." American Public Health Association **28**(3): 351-372.

Woodruff, Tracy et al. (2010). Clinical Proceedings: *Environmental Impacts on Reproductive Health*. Association of Reproductive Health Professionals.

World Health Organization Europe. (2005). WHO Technical Meeting on Quantifying Disease from Inadequate Housing, Bonn, Germany.

Appendices

Appendix A

Survey Questions- Final Draft

Town Health Officer Rental Housing Inspection Checklist Quality Assurance Survey

1. Did you complete the Town Health Officer Rental Housing Checklist?
Yes
No
2. On average, how long did it take you to fill out and complete a checklist? _____
3. When did you usually complete the checklist?
During the inspection
After the inspection, but during normal business hours
After business hours
4. Where did you usually complete the checklist?
At the site
In my car
At home
At the office
5. How would you describe the length of the checklist?
Too long
Too short
Just right
6. Would you make any changes to the checklist?
Yes
No
(If YES, please specify the changes you would make) _____
7. Do the questions correlate with or relate well to the rental housing health code?
Yes
No
(If NO, please specify which questions did not relate well) _____
8. Are there valuable topics missing from this checklist?
Yes
No
Unsure
(If YES, please specify) _____
9. Did the sections flow logically with how you walked through the house?
Yes
No
(If NO, how can the sections flow more logically according to how you walked through the house?) _____
10. Did the questions within each section flow logically? (e.g. Did it make sense to start in the kitchen and then proceed to the bathroom?)
Yes
No
Unsure
11. If NO, what section on the questionnaire would you start with and end with?
Start with _____
End with _____
12. Was it clear what the questions were asking?
Always
Often
Sometimes
Rarely
13. If SOMETIMES or RARELY, how can the questions be clarified?
Make the questions shorter
Make the questions more detailed
Make the typeface a larger font

- Other (please specify)
14. Were the check boxes that followed the questions clearly labeled?
Yes
No
15. Would any of the following suggestions make the check boxes more clear?
Making the boxes larger (YES or NO)
Coloring the boxes (YES or NO)
Shading every other check box (YES or NO)
16. How would you rate the new questionnaire on a scale of 1 to 10? (1=very bad and 10=very good)

17. In your opinion, how useful was the checklist in identifying asthma triggers in the rental property? (Some examples of asthma triggers include mold as well as rodent and cockroach infestation)
Very useful
Somewhat useful
Not useful
Unsure
18. Please explain your answer to the previous question (Explain what kinds of asthma triggers you encountered most often) _____
19. Was there an individual suffering from asthma living in one or more of the rental properties you inspected?
Yes
No
Unsure

Demographic Questions

1. Is there an area in your town in which you observed increased rates of asthma triggers in rental properties?
Yes
No
Unsure
2. How long have you been a Town Health Officer? _____
3. What is your occupation? _____
4. What is your age? _____
5. Are you a town employee?
Yes
No
Unsure
6. For which town are you a town health officer? _____

Appendix B